

Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1-44. (Canceled)

45. (Currently Amended) An programming system usable to generate instructions for controlling a corresponding machine vision inspection system, the programming system comprising:

a user interface usable for programming of the corresponding machine vision inspection system, comprising:

an image display portion usable to display a synthetic image representative of an image acquired by the corresponding machine vision inspection system, and

user-alterable control elements usable to determine instructions usable to control the corresponding machine vision inspection system, the user-alterable control elements comprising at least one control element that affects the focus of the synthetic image representative of an image acquired by the corresponding machine vision inspection system, and

an input portion for receiving CAD data representative of at least a portion of at least one object inspectable by the corresponding machine vision inspection system;

a hardware component simulation system, comprising:

a first portion operable to represent at least a current lens system of the corresponding machine vision inspection system, including a limited depth of field of the lens system, and

a second portion operable to represent a current state of at least the relative position of the lens system and the portion of at least one object inspectable by the corresponding machine vision inspection system;

a communication interface portion connected to exchange control and data signals between the user interface and the hardware component simulation system; and

a portion usable to generate the instructions for controlling the corresponding machine vision inspection system;

wherein the programming system is operable to:

generate a current focus-dependent synthetic image of at least the portion of at least one object inspectable by the corresponding machine vision inspection system, including focus effects related to the limited depth of field of the lens system, based on at least two of a current state of the user-alterable control elements, the current lens system representation of the first portion and the current state representation of the second portion;

display the current focus-dependent synthetic image in the image display portion of the user interface; and

generate at least one of the instructions that is usable in an inspection program for controlling the corresponding machine vision inspection system to inspect the at least one object inspectable by the corresponding machine vision inspection system, based at least partially on the current state of the user-alterable control elements.

46. (Currently Amended) The programming system of claim 45, wherein the at least one instruction that is usable in an inspection program for controlling the corresponding machine vision inspection system to inspect the at least one object includes at least one instruction that determines that a focus-dependent actual inspection image of the at least one object inspectable by the corresponding machine vision inspection system will exhibit respective relatively-more-focused regions of the object corresponding to respective

relatively-more-focused regions of the object in the current focus-dependent synthetic image and respective relatively-less-focused regions of the object corresponding to respective relatively-less-focused regions of the object in the current focus-dependent synthetic image.

47. (Currently Amended) The programming system of claim 45, wherein the at least one control element that affects the focus of the synthetic image appears and operates substantially similarly to a control element included in a user interface of the corresponding machine vision inspection system for affecting the focus of the corresponding machine vision inspection system.

48. (Currently Amended) The programming system of claim 45, wherein the at least one control element that affects the focus of the synthetic image comprises at least one of a) a focusing control element operable on the synthetic image representative of an image acquired by the corresponding machine vision inspection system and b) a motion control element.

49. (Currently Amended) The programming system of claim 45, wherein the representation of at least a current lens system of the corresponding machine vision inspection system includes a representation of a plurality of lenses usable as the current lens system of the corresponding machine vision inspection system.

50. (Currently Amended) The programming system of claim 45, wherein the programming system automatically modifies and displays a modified current focus-dependent synthetic image in response to a modification of at least one of a) the current state of the user-alterable control elements, b) the current lens system representation of the first portion and c) the current state representation of the second portion.

51. (Currently Amended) The programming system of claim 45, wherein:
the corresponding machine vision inspection system includes a user interface including user-alterable control elements and an image display portion;

the user interface of the programming system is substantially similar to the user interface of the corresponding machine vision inspection system; and

the user-alterable control elements of the programming system comprise a majority of the user-alterable control elements of the corresponding machine vision inspection system, such that the majority of the user-alterable control elements typically appear and operate substantially similarly in both the programming system and the corresponding machine vision inspection system.

52. (Currently Amended) The programming system of claim 45, wherein:

the hardware component simulation system further comprises a third portion operable to represent a current state of a lighting system of the corresponding machine vision inspection system;

the user-alterable control elements comprise at least one control element that affects the apparent lighting in the synthetic image representative of an image acquired by the corresponding machine vision inspection system; and

the programming system is operable to generate the current focus-dependent synthetic image based on at least three of a current state of the user-alterable control elements, the current lens system representation of the first portion, the current state representation of the second portion and the current state representation of the third portion.

53. (Currently Amended) The programming system of claim 52, wherein the at least one control element that affects the apparent lighting in the synthetic image comprises a user-alterable control element of the corresponding machine vision inspection system, such that the at least one control element that affects the apparent lighting in the synthetic image appears and operates substantially similarly in both the programming system and the corresponding machine vision inspection system.

54. (Currently Amended) The programming system of claim 45, wherein:

the user-alterable control elements are operable to determine instructions for controlling the programming system which are substantially similar to instructions determined by the corresponding user-alterable control elements of the corresponding machine vision inspection system for controlling the corresponding machine vision inspection system, when the user-alterable control elements of the respective system are similarly operated;

the hardware component simulation system processes some of the instructions in order to generate the current focus-dependent synthetic image;

the user-alterable control elements include elements operable to determine image inspection instructions substantially similar to at least one image inspection instruction usable in the inspection program for the at least one object inspectable by the corresponding machine vision inspection system; and

the hardware component simulation system generates the current focus-dependent synthetic image in a form which is operable with the image inspection instructions to provide an environment for training a part program based on a focus-dependent synthetic image that is substantially similar to an environment that is provided by the corresponding machine vision inspection system for training a part program based on a focus-dependent actual image.

55. (Currently Amended) An programming system usable to generate instructions for controlling a corresponding machine vision inspection system, the programming system comprising:

a user interface usable for programming of the corresponding machine vision inspection system, comprising:

an image display portion usable to display a synthetic image representative of an image acquired by the corresponding machine vision inspection system, and

user-alterable control elements usable to determine instructions for controlling the programming system that correspond to the instructions for controlling the corresponding machine vision inspection system, the user-alterable control elements comprising at least a first control element that affects the focus of the synthetic image representative of an image acquired by the corresponding machine vision inspection system and at least a second control element which is operable to determine an image inspection operation to be performed on the synthetic image representative of an image acquired by the corresponding machine vision inspection system,

an input portion for receiving CAD data representative of at least a portion of at least one object inspectable by the corresponding machine vision inspection system;

a hardware component simulation system, comprising:

a first portion operable to represent at least a current lens system of the corresponding machine vision inspection system, including a limited depth of field of the lens system, and

a second portion operable to represent a current state of at least the relative position of the lens system and the portion of at least one object inspectable by the corresponding machine vision inspection system;

a communication interface portion connected to exchange control and data signals between the user interface and the hardware component simulation system; and

a portion usable to generate the instructions for controlling the hardware component simulation system,

wherein the programming system is operable to:

generate a current focus-dependent synthetic image of at least the portion of at least one object inspectable by the corresponding machine vision inspection system including focus effects related to the limited depth of field of the lens system, based on at least two of a current state of the user-alterable control elements, the current lens system representation of the first portion and the current state representation of the second portion;

display the current focus-dependent synthetic image in the image display portion of the user interface; and

perform an inspection operation based on the current focus-dependent synthetic image, the image inspection operation determined by operating the second control element.

56. (Currently Amended) The programming system of claim 55, wherein the programming system is further operable to generate at least one control instruction usable in an inspection program for the at least one object, inspectable by the corresponding machine vision inspection system, based at least partially on the current state of the user-alterable control elements.

57. (Currently Amended) An machine vision inspection simulation system usable to generate instructions for controlling a corresponding machine vision inspection system that includes a user interface comprising at least an image display portion, user-alterable control elements comprising at least one control element that affects the focus of the synthetic image representative of an image acquired by the corresponding machine vision inspection system and at least one control element which is operable to determine an image inspection operation, the machine vision inspection simulation system comprising:

a user interface that is usable for programming of the corresponding machine vision inspection system and that is substantially similar to the user interface of the corresponding machine vision inspection system, comprising:

an image display portion usable to display a synthetic image representative of an image acquired by the corresponding machine vision inspection system; and

a plurality of user-alterable control elements usable to determine instructions for controlling the programming system that correspond to the instructions for controlling the corresponding machine, the user-alterable control elements comprising at least one control element that affects the focus of the synthetic image representative of an image acquired by the corresponding machine vision inspection system and at least one control element which is operable to perform an inspection operation on the synthetic image representative of an image acquired by the corresponding machine vision inspection system,

wherein the user-alterable control elements comprise a majority of the user-alterable control elements of the corresponding machine vision inspection system such that the majority of the user-alterable control elements typically appear and operate substantially similarly in both the machine vision inspection simulation system and the corresponding machine vision inspection system;

an input portion for receiving CAD data representative of at least a portion of at least one object inspectable by the corresponding machine vision inspection system;

a hardware component simulation system, comprising:

a first portion operable to represent at least a current lens system of the corresponding machine vision inspection system, including a limited depth of field of the lens system, and

a second portion operable to represent a current state of at least the relative position of the lens system and the portion of at least one object inspectable by the corresponding machine vision inspection system; and

a communication interface portion connected to exchange control and data

signals between the user interface and the hardware component simulation system,

wherein the machine vision inspection simulation system is operable to:

generate a current focus-dependent synthetic image of at least the portion of at least one object inspectable by the corresponding machine vision inspection system including focus effects related to the limited depth of field of the lens system, based on at least two of a current state of the user-alterable control elements, the current lens system representation of the first portion and the current state representation of the second portion;

display the current focus-dependent synthetic image in the image display portion of the user interface; and

operate at least one control element which is operable to perform an image inspection operation based on the current focus-dependent synthetic image.

58. (Currently Amended) The machine vision inspection simulation system of claim 57, wherein the representation of at least a current lens system of the corresponding machine vision inspection system includes a representation of a plurality of lenses usable as the current lens system of the corresponding machine vision inspection system.

59. (Currently Amended) The machine vision inspection simulation system of claim 57, wherein the machine vision inspection simulation system automatically modifies and displays a modified current focus-dependent synthetic image in response to a modification of at least one of a) the current state of the user-alterable control elements, b) the current lens system representation of the first portion and c) the current state representation of the second portion.

60. (Currently Amended) The machine vision inspection simulation system of claim 57, wherein:

the hardware component simulation system further comprises a third portion operable to represent a current state of a lighting system of the corresponding machine vision inspection system;

the user-alterable control elements comprise at least one control element that affects the apparent lighting in the synthetic image representative of an image acquired by the corresponding machine vision inspection system; and

the machine vision inspection simulation system is operable to generate the current focus-dependent synthetic image based on at least three of a current state of the user-alterable control elements, the current lens system representation of the first portion, the current state representation of the second portion and the current state representation of the third portion.

61. (Currently Amended) The machine vision inspection simulation system of claim 60, wherein the representation of a current state of a lighting system of the corresponding machine vision inspection system includes a representation of the current state of a plurality of lights of the corresponding machine vision inspection system.

62. (Currently Amended) The machine vision inspection simulation system of claim 57 wherein:

the user-alterable control elements are operable to input operation instructions which are substantially similar to the control instructions associated with the operations of corresponding user-alterable control elements of the corresponding machine vision inspection system;

the hardware component simulation system processes the input operation instructions in order to generate the current focus-dependent synthetic image; and

the hardware component simulation system generates the current focus-dependent synthetic image in a form which is operable with the at least one control element

which is operable to perform an image inspection operation based on the current focus-dependent synthetic image to provide an environment for training a part program based on a focus-dependent synthetic image that is substantially similar to an environment that is provided by the corresponding machine vision inspection system for training a part program based on a focus-dependent actual image.

63. (Currently Amended) The machine vision inspection simulation system of claim 57 further comprising a portion usable to generate instructions for controlling the corresponding machine vision inspection system, wherein the machine vision inspection simulation system is further operable to generate at least one instruction usable in an inspection program for controlling the corresponding machine vision inspection system to inspect the at least one object inspectable by the corresponding machine vision inspection system, based at least partially on the current state of the user-alterable control elements.

64. (Currently Amended) The machine vision inspection simulation system of claim 57, wherein the user interface of the machine vision inspection simulation system further comprises an external view representing the overall configuration of the corresponding machine vision inspection system corresponding to a current operating state of the machine vision inspection simulation system.

65. (Currently Amended) A method of operating an programming system usable to generate the instructions for controlling a corresponding machine vision inspection system, the programming system comprising:

a user interface usable for programming of the corresponding machine vision inspection system, comprising:

an image display portion usable to display a synthetic image representative of an image acquired by the corresponding machine vision inspection system, and

user-alterable control elements usable to determine instructions usable for controlling the corresponding machine vision inspection system, the user-alterable control elements comprising at least one control element that affects the focus of the synthetic image representative of an image acquired by the corresponding machine vision inspection system;

a hardware component simulation system, comprising:

a first portion operable to represent at least a current lens system of the corresponding machine vision inspection system, including a limited depth of field of the lens system, and

a second portion operable to represent a current state of at least the relative position of the lens system and the portion of at least one object inspectable by the corresponding machine vision inspection system; and

a communication interface portion connected to exchange control and data signals between the user interface and the hardware component simulation system;

the method comprising:

inputting CAD data representative of at least a portion of at least one object inspectable by the corresponding machine vision inspection system;

generating a current focus-dependent synthetic image of at least the portion of at least one object inspectable by the corresponding machine vision inspection system including focus effects related to the limited depth of field of the lens system, based on at least two of a current state of the user-alterable control elements, the current lens system representation of the first portion and the current state representation of the second portion;

displaying the current focus-dependent synthetic image in the image display portion of the user interface; and

generating at least one instruction usable in an inspection program for controlling the corresponding machine vision inspection system to inspect the at least one

object inspectable by the corresponding machine vision inspection system, based at least partially on the current state of the user-alterable control elements.

66. (Previously Presented) The method of claim 65, further comprising altering the at least one control element that affects the focus of the synthetic image to provide a new current state of at least that control element.

67. (Previously Presented) The method of claim 65, further comprising automatically modifying and displaying a modified current focus-dependent synthetic image in response to a modification of at least one of a) the current state of the user-alterable control elements, b) the current lens system representation of the first portion and c) the current state representation of the second portion.

68. (Previously Presented) The method of claim 65, further comprising:

operating at least one control element which is operable to perform an image inspection operation based on the current focus-dependent synthetic image.

69. (Currently Amended) A method of using a machine vision inspection system simulation for a corresponding machine vision inspection system that includes a user interface comprising at least an image display portion, user-alterable control elements comprising at least one control element that affects the focus of the image acquired by the corresponding machine vision inspection system and at least one control element which is operable to determine an image inspection operation, the simulation system comprising:

a user interface that is usable for programming of the corresponding machine vision inspection system and that is substantially similar to the user interface of the corresponding machine vision inspection system, comprising:

an image display portion usable to display a synthetic image representative of an image acquired by the corresponding machine vision inspection system,

a plurality of user-alterable control elements usable to determine instructions for controlling the programming system that correspond to instructions for controlling the corresponding machine, the user-alterable control elements comprising at least one control element that affects the focus of the synthetic image representative of an image acquired by the corresponding machine vision inspection system and at least one control element which is operable to perform an inspection operation,

wherein the user-alterable control elements of the machine vision inspection simulation system comprise a majority of the user-alterable control elements of the corresponding machine vision inspection system such that that majority of the user-alterable control elements and image processing tools typically appear and operate substantially similarly in both the machine vision inspection simulation system and the corresponding machine vision inspection system;

a hardware component simulation system, comprising:

a first portion operable to represent at least a current lens system of the corresponding machine vision inspection system, including a limited depth of field of the lens system, and

a second portion operable to represent a current state of at least the relative position of the lens system and the portion of at least one object inspectable by the corresponding machine vision inspection system; and

a communication interface portion connected to exchange control and data signals between the user interface and the hardware component simulation system;

the method comprising:

inputting CAD data representative of at least a portion of at least one object inspectable by the corresponding machine vision inspection system;

generating a current focus-dependent synthetic image of at least the portion of

at least one object inspectable by the corresponding machine vision inspection system including focus effects related to the limited depth of field of the lens system, based on at least two of a current state of the user-alterable control elements, the current lens system representation of the first portion and the current state representation of the second portion; displaying the current focus-dependent synthetic image in the image display portion of the user interface; and

operating at least one control element which is operable to perform an inspection operation based on the current focus-dependent synthetic image.

70. (Previously Presented) The method of claim 69, further comprising automatically modifying and displaying a modified current focus-dependent synthetic image in response to a modification of at least one of a) the current state of the user-alterable control elements, b) the current lens system representation of the first portion and c) the current state representation of the second portion.

71. (Previously Presented) The method of claim 69, wherein the hardware component simulation system further comprises a third portion operable to represent a current state of a lighting system of the corresponding machine vision inspection system and the user-alterable control elements comprise at least one control element that affects the apparent lighting in the synthetic image representative of an image acquired by the corresponding machine vision inspection system, and wherein generating the current focus-dependent synthetic image further comprises basing the current focus-dependent synthetic image on the current state representation of the third portion.

72. (Previously Presented) The method of claim 69, further comprising generating at least one control instruction usable in an inspection program for the at least one object inspectable by the corresponding machine vision inspection system, based at least partially on the current state of the user-alterable control elements.

73. (Currently Amended) An programming system comprising:

a first portion of a machine vision inspection system;

a hardware component simulation system that simulates a second portion of the machine vision system, the hardware component simulation system including:

a first part that represents a lens system including a limited depth of field of the second portion of the machine vision inspection system, and

a second part that represents a current state of the relative position of the lens system and a portion of an object to be inspected by the first portion of the machine vision inspection system;

a communication interface between the first portion of the machine vision system and the hardware component simulation system, wherein the programming system generates instructions for controlling the machine vision inspection system.